

CLAIMS

WHAT IS CLAIMED:

1. A method, comprising:

processing a plurality of workpieces to form at least one feature on each workpiece;

5 measuring a plurality of characteristics of the feature;

constructing a covariance matrix including diagonal and non-diagonal terms for the

plurality of characteristics measured;

monitoring at least the non-diagonal terms of the covariance matrix; and

determining a sampling plan for measuring the workpieces based on the monitoring.

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2. The method of claim 1, wherein monitoring the non-diagonal terms of the covariance matrix further comprises determining that at least one of the non-diagonal terms has crossed a predetermined threshold.

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3. The method of claim 1, wherein monitoring the non-diagonal terms of the covariance matrix further comprises identifying a trend in at least one of the non-diagonal terms.

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4. The method of claim 1, wherein monitoring the non-diagonal terms of the covariance matrix further comprises:

receiving measurements of the characteristics of the feature on a current workpiece;

identifying relationships between the measurements of the characteristics for the current workpiece;

comparing the identified relationships to relationships present in the covariance

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matrix as defined by the non-diagonal terms; and

identifying a mismatch between the relationships for the measurements of the characteristics for the current workpiece and the relationships present in the covariance matrix.

5 5. The method of claim 1, wherein monitoring the non-diagonal terms of the covariance matrix further comprises calculating at least one singular value for the covariance matrix, and determining the sampling plan further comprises determining a sampling frequency of the sampling plan as a function of the singular value.

10 6. The method of claim 6, wherein determining the sampling plan further comprises determining the sampling frequency as a multiple of the singular value.

7. The method of claim 1, wherein determining the sampling plan further comprises determining a sampling plan for subsequently processed workpieces.

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8. The method of claim 1, wherein monitoring the non-diagonal terms of the covariance matrix further comprises identifying a disturbance in the covariance matrix, and determining the sampling plan further comprises associating a particular workpiece with a deviation in the covariance matrix and determining a sampling plan for the particular
20 workpiece.

9. The method of claim 1, wherein determining the sampling plan further comprises determining a sampling frequency based on the monitoring.

10. The method of claim 1, wherein determining the sampling plan further comprises selecting a particular workpiece for subsequent metrology collection based on the monitoring.

5 11. A system, comprising:
a plurality of tools configured to process a plurality of workpieces to form at least one feature on each workpiece;
at least one metrology tool configured to measure a plurality of characteristics of the feature;
10 a sampling controller configured to construct a covariance matrix including diagonal and non-diagonal terms for the plurality of characteristics measured, monitor at least the non-diagonal terms of the covariance matrix, and determine a sampling plan for measuring the workpieces based on the monitoring.

15 12. The system of claim 11, wherein the sampling controller is further configured to monitor the non-diagonal terms of the covariance matrix by determining that at least one of the non-diagonal terms has crossed a predetermined threshold.

20 13. The system of claim 11, wherein the sampling controller is further configured to monitor the non-diagonal terms of the covariance matrix by identifying a trend in at least one of the non-diagonal terms.

25 14. The system of claim 11, wherein the sampling controller is further configured to monitor the non-diagonal terms of the covariance matrix by receiving measurements of the characteristics of the feature on a current workpiece, identifying relationships between the

measurements of the characteristics for the current workpiece, comparing the identified relationships to relationships present in the covariance matrix as defined by the non-diagonal terms, and identifying a mismatch between the relationships for the measurements of the characteristics for the current workpiece and the relationships present in the covariance matrix.

15. The system of claim 11, wherein the sampling controller is further configured to calculate at least one singular value for the covariance matrix and determine a sampling frequency of the sampling plan as a function of the singular value.

16. The system of claim 16, wherein the sampling controller is further configured to determine the sampling frequency as a multiple of the singular value.

17. The system of claim 11, wherein the sampling controller is further configured to determine a sampling plan for subsequently processed workpieces.

18. The system of claim 11, wherein the sampling controller is further configured to identify a disturbance in the covariance matrix, associate a particular workpiece with a deviation in the covariance matrix, and determine a sampling plan for the particular workpiece.

19. The system of claim 11, wherein the sampling controller is further configured to determine a sampling frequency based on the monitoring.

20. The system of claim 11, wherein the sampling controller is further configured to select a particular workpiece for subsequent metrology collection.

21. A system, comprising:

5 means for processing a plurality of workpieces to form at least one feature on each workpiece;

means for measuring a plurality of characteristics of the feature;

means for constructing a covariance matrix including diagonal and non-diagonal terms for the plurality of characteristics measured;

10 means for monitoring at least the non-diagonal terms of the covariance matrix; and

means for determining a sampling plan for measuring the workpieces based on the monitoring.

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